

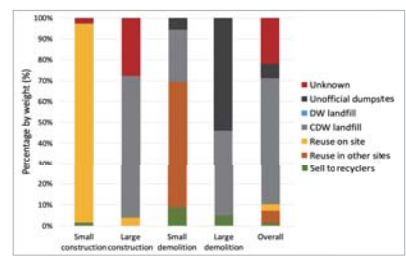
IA-6 Construction and Demolition Waste: Recycling Potential in Hanoi, Vietnam

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INTRODUCTION



Prevalent fly-tipping

- ### Low rate of CDW reuse and recycling
- Only about **10%** of CDW generation is reused and recycled
 - prevalent fly-tipping (illegal dumping)
 - No CDW recycling plant is in operation in Vietnam
 - No study on feasibility of CDW recycling industry



OBJECTIVES

1. To identify supply and demand for the concrete waste (CW) recycling industry in Hanoi, Vietnam
2. To identify costs and benefits of CW recycling plants

METHODOLOGY

1. Supply and demand estimation

- Supply of concrete waste: based on the weight-per-construction-area method
- Demand for Recycled Concrete Aggregates (RCA): amounts of virgin aggregates needed for road base and sub-base



2. Cost and benefit analysis

- Costs: capital costs and operating costs.
- Financial benefits: RCA sales, plant remaining value, savings on transportation.
- Economic benefits: financial benefits plus environmental benefits (greenhouse gas emission reductions).
- Feasibility indicators: Net Present Value (NPV), Internal Rate of Return (IRR).

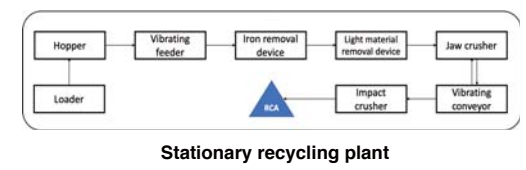
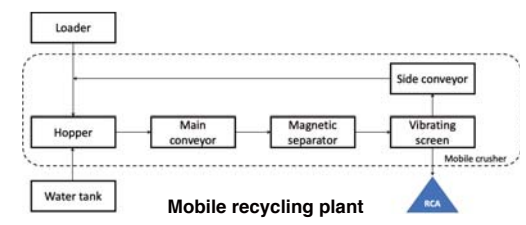
$$NPV = \sum_{t=1}^n \frac{\text{Cash inflow} - \text{Cash outflow}}{(1 + \text{discount rate})^{\text{year } t}}$$

• IRR: discount rate when NPV=0.

👍: NPV>0, IRR>12%

• Primary data: machine quotations, interviews with local experts and companies.

• Secondary data: governmental regulations and previous studies.



RESULTS

1. Estimated supply and demand for CW recycling

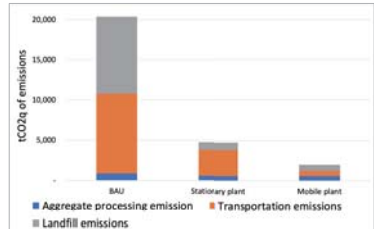
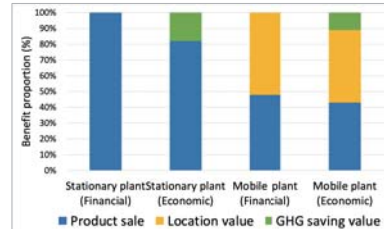


- 98% of CW generated is from demolition activities.
- Demand for RCA outstrips supply since 2015 owing to the transportation development master plan.

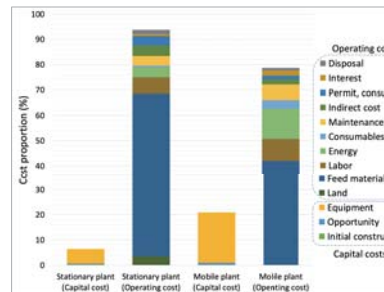
Estimated supply of CW and demand for RCA

2. Estimated costs and benefits

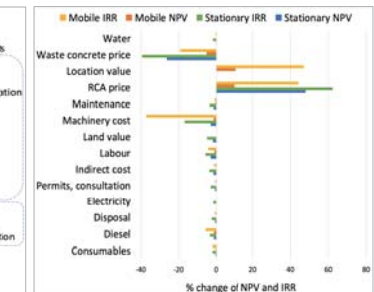
- RCA sales are the main source of income for both fixed and mobile plants.
- Location advantage contributes to ~50% of the mobile plant's value.
- The lack of transport necessity makes the mobile plant more environmentally friendly.



Proportions of benefit components



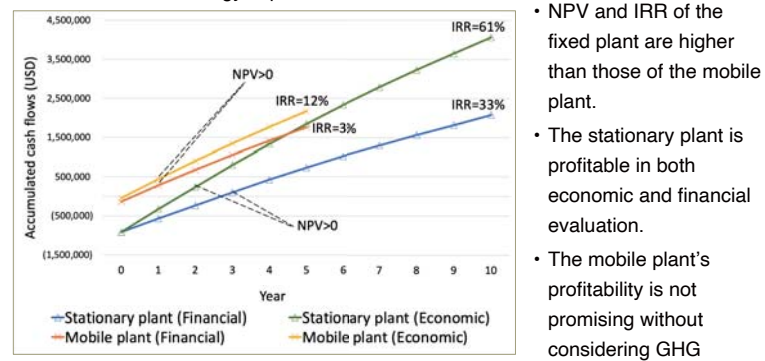
GHG emission comparison



Proportions of cost components

- The mobile recycling plant is more capital intensive than the fixed plant.
- Feed material (CW) is the most significant cost component in operating overhead.
- Feasibility of the stationary plant is sensitive to labor cost, whilst the mobile plant is more sensitive to energy expense.

Viability change by 10% changes in parameters



Accumulated cash flows of the recycling plants

CONCLUSIONS

1. The study findings demonstrate an **encouraging** market for RCA to be used in place of virgin raw aggregates in road construction.
2. The stationary plant is capable of **competing favorably** with natural aggregates whilst the mobile plant will **struggle to be self-sustainable** if its positive externality is not taken into account.
3. The prices of RCA and feed material have the **strongest impact on the viability** of the construction and demolition recycling industry, indicating that policies supporting RCA should **target** these two factors.